



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
-----------------	-------------	----------------------	---------------------	------------------

10/521,356

08/08/2005

Milo Sebastian Peter Shaffer

011765-0314577

9306

909

7590

05/12/2009

PILLSBURY WINTHROP SHAW PITTMAN, LLP
P.O. BOX 10500
MCLEAN, VA 22102

EXAMINER

VETERE, ROBERT A

ART UNIT

PAPER NUMBER

1792

MAIL DATE

DELIVERY MODE

05/12/2009

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/521,356	Applicant(s) SHAFFER ET AL.	
	Examiner ROBERT VETERE	Art Unit 1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 09 January 2009.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 6-20 and 23-25 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 6-20, 23-25 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

Art Unit: 1792

DETAILED ACTION

Examiner's Comments

An amendment, cancelling claims 2-5 and 21-22 and amending claims 1 and 23-25 was received on 1/9/09.

Claim Rejections - 35 USC § 102

1. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(a) the invention was known or used by others in this country, or patented or described in a printed publication in this or a foreign country, before the invention thereof by the applicant for a patent.

2. Claim 26 is rejected under 35 U.S.C. 102(a) as being anticipate by Resasco et al. (US 6,333,016).

Claim 26: Resasco teaches a continuous (5:67) method of producing carbon nanotubes comprising the steps of: coating carrier particles, such as silica and alumina (5:30-35) with a thermally decomposable catalyst, such as a bimetal catalyst comprising cobalt and molybdenum (4:52-65; 5:25-30), decomposing the metal salt catalyst to yield carrier particles coated with the catalyst (5:25-30), flowing a carbon-containing gas, such as methane, acetylene or CO, over the particles (5:50:61) to yield nanotubes (5:62-6:18), such as single walled nanotubes (6:7-18) and collecting the formed nanotubes (6:7-18).

"[E]ven though product-by-process claims are limited by and defined by the process, determination of patentability is based on the product itself. The patentability of a product does not depend on its method of production. If the product in the product-by-process claim is the same as or obvious from a product of the prior art, the claim is unpatentable even though the prior product was made by a different process."

In re Thorpe, 777 F.2d 695, 698, 227 USPQ 964, 966 (Fed. Cir. 1985).

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the

Art Unit: 1792

invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 1, 6-13, 15-19 and 24-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco et al. (US 6,333,016) in light of Tennent et al. (US 5,165,909) and Tennent et al. (US 5,578,543, hereinafter "Tennent II") and further in light of Kawakami et al. (US 2003/0086859).

Claims 1, 6-13, 18-19, 24 and 26: Resasco teaches a continuous (5:67) method of producing carbon nanotubes comprising the steps of: coating carrier particles, such as silica and alumina (5:30-35) with a thermally decomposable catalyst, such as a bimetal catalyst comprising cobalt and molybdenum (4:52-65; 5:25-30), decomposing the metal salt catalyst to yield carrier particles coated with the catalyst (5:25-30), flowing a carbon-containing gas, such as methane, acetylene or CO, over the particles (5:50-61) to yield nanotubes (5:62-6:18), such as single walled nanotubes (6:7-18) and collecting the formed nanotubes (6:7-18).

What Resasco fails to teach is that the metal salt is formate or oxalate. Tennent teaches a method of forming carbon nanotubes (Abst.) comprising the steps of forming a catalyst from a decomposable metal salt, such as an oxalate (8:1-10), decomposing the metal salt in a non-reducing atmosphere to form the catalyst (8:1-10; 13:1-10, Table 1), flowing a carbon source gas, such as methane or acetylene (7:36-53) comprising argon as a diluent (7:54-65) over the catalyst to form carbon nanotubes (Abst.). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Because both Tennent and Resasco teach methods of forming nanotubes by flowing methane or acetylene over a decomposed metal salt catalyst, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used an oxalate salt, as taught by Tennent, in the method of Resasco with the predictable expectation of success.

Resasco and Tennent fail to teach that the particles are fluidized and that the transition metal is heated on the substrate. Resasco does teach that the particles are exposed to a stream of inert gas within the reaction vessel before being exposed to the carbon source (8:35-53). Tennent II, however, teaches a method of forming nanotubes by reacting a carbon source gas with catalyst coated particles

Art Unit: 1792

wherein the particles are fluidized during the continuous reaction (6:26-60). With respect to the limitation that the particles are collected by elution, Kawakami explains that elution is a technique known to those of ordinary skill in the art for collecting nanoparticles (§ 0162, e.g.). Thus, even if the teaching of Resasco does not constitute fluidizing the particles, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have fluidized the particles during the reaction with the predictable expectation of success because both the method of Resasco and Tennent II contain the same steps. Furthermore, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have collected the nanoparticles by elution because elution is well known in the art at the time of the invention as a means for collecting nanoparticles with the predictable expectation of success.

Claims 15-17: Tennent also teaches that the temperature at which the metal salt is decomposed varies from about 500°C to about 950°C, depending on the carbon source gas used, and can be as high as about 1200°C (8:1-10; 8:59-9:7).

Claim 25: Kawakami further teaches a method of forming nanotubes (Abst.) using nickel formate instead of nickel carbonyl as the catalyst (§ 0078). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used nickel formate in the method of Resasco and Unger with the predictable expectation of success.

3. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco, Tennent, Tennent II and Kawakami in light of Lieber et al. (US 5,997,832).

Claim 14: Resasco teaches the use of alumina or silica as the carrier particles, but fails to expressly teach whether they are in the form of fumed powders. Lieber teaches a method of forming carbon nanotubes wherein a carrier particle, such as fumed alumina, is coated with a metal catalyst (2:45-58; 5:29-46) and a hydrocarbon source gas (2:37-44) is reacted with the catalyst to form carbon nanorods (see, e.g., 5:12-18). The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Because both Resasco and Lieber teach substantially similar

Art Unit: 1792

methods of forming carbon nanotubes and because Resasco is silent regarding the form of the alumina carrier particles, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used fumed alumina powder as the carrier particles, as taught by Lieber, in the method of Resasco with the predictable expectation of success.

4. Claim 20 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco, Tennent, Tennent II and Kawakami in light of Resasco et al. (US 6,955,800, hereinafter "Resasco II").

Claim 20: Resasco II teaches a method of forming carbon nanotubes wherein catalytic particles are exposed to a carbon source gas to form the nanotubes (3:59-4:19). Resasco II explains that the carrier particles are impregnated with the catalytic metal compound. Resasco I, however, also teaches that zeolites can be used as the catalyst material (5:30-:35), which are highly porous and usually used to impregnate porous structures. The selection of a known material based on its suitability for its intended use supported a prima facie obviousness determination in *Sinclair & Carroll Co. v. Interchemical Corp.*, 325 U.S. 327, 65 USPQ 297 (1945). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have impregnated the carrier particles with the catalyst, as taught by Resasco II, in the method of Resasco in order to have improved the economy of the nanotube forming process.

5. Claim 23 is rejected under 35 U.S.C. 103(a) as being unpatentable over Resasco, Tennent, Tennent II and Kawakami in light of Kohlen et al. (US 6,290,775).

Claim 23: Resasco and Tennent II teach all the limitations of claim 23 except that the reaction occurs on an inclined surface. Kohlen explains that it is well known in the art that a fluidized bed reactors can be arranged vertically or at an angle (1:20-23). Thus, it would have been obvious to one of ordinary skill in the art at the time the invention was made to have arranged the fluidized bed reaction of the combined method of Resasco and Tennent II on an incline, as taught by Kohlen, with the predictable expectation of success because it is well known in the art to use an inclined fluidized bed for a reaction.

Response to Arguments

6. Applicant's arguments filed 1/9/2009 have been fully considered but they are not persuasive.

Art Unit: 1792

Applicant first argues that Resasco fails to teach that the metal salt is a formate or oxalate. This is correct. However, in light of the rejection presented above, this argument is moot.

Applicant next argues that Tennent fails to teach that the formate or oxalate is decomposable under a non-reducing atmosphere. This is not persuasive. Tennent teaches that the oxalate catalyst can be decomposed under an Ar atmosphere (Table I). The fact that catalysts which are decomposed in this manner fail to yield fibrils, as applicant points out, is not relevant to determining that the limitation "decomposable to yield the transition metal under a non-reducing atmosphere" has been met. Whether fibrils form or not, Tennent teaches that the oxalate is decomposable under an inert atmosphere and that such decomposition yields the transition metal.

Applicant also argues that because Lieber teaches a method of forming carbide nanorods, one of ordinary skill in the art would not have been motivated to combine Lieber with Resasco. This is not persuasive. Resasco teaches that the substrate is an aluminum particle, but not that it is a fumed powder. Lieber teaches that fused aluminum can be used as a substrate to grow nanotubes. "A person of ordinary skill in the art is also a person of ordinary creativity, not an automaton." *KSR v. Teleflex*, 550 U.S. at ___, 82 USPQ2d at 1397. "[I]n many cases a person of ordinary skill will be able to fit the teachings of multiple patents together like pieces of a puzzle." *Id.* While the synthetic methods involved in the formation of carbide nanotubes may differ from that involved in the formation of carbon nanotubes, one of ordinary skill in the art would have recognized that fumed aluminum could be used in the place of aluminum particles in a method for forming nanotubes in general, based on the teaching of Lieber.

Conclusion

7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

Art Unit: 1792

the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to ROBERT VETERE whose telephone number is (571)270-1864. The examiner can normally be reached on Mon-Fri 9-6.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Michael Cleveland can be reached on 571-272-1418. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Robert Vetere/
Examiner, Art Unit 1792

/Michael Cleveland/
Supervisory Patent Examiner, Art Unit 1792